Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion

Participant
Sunflower Electric Power Corporation

Additional Team Members
Electric Power Research Institute—cofunder

Foster Wheeler Energy Corporation—technology supplier

GE Energy and Environmental Research Corp.—technology supplier

Location
Garden City, Finney County, KS (Sunflower Electric's Holcomb Station, Unit No. 1)

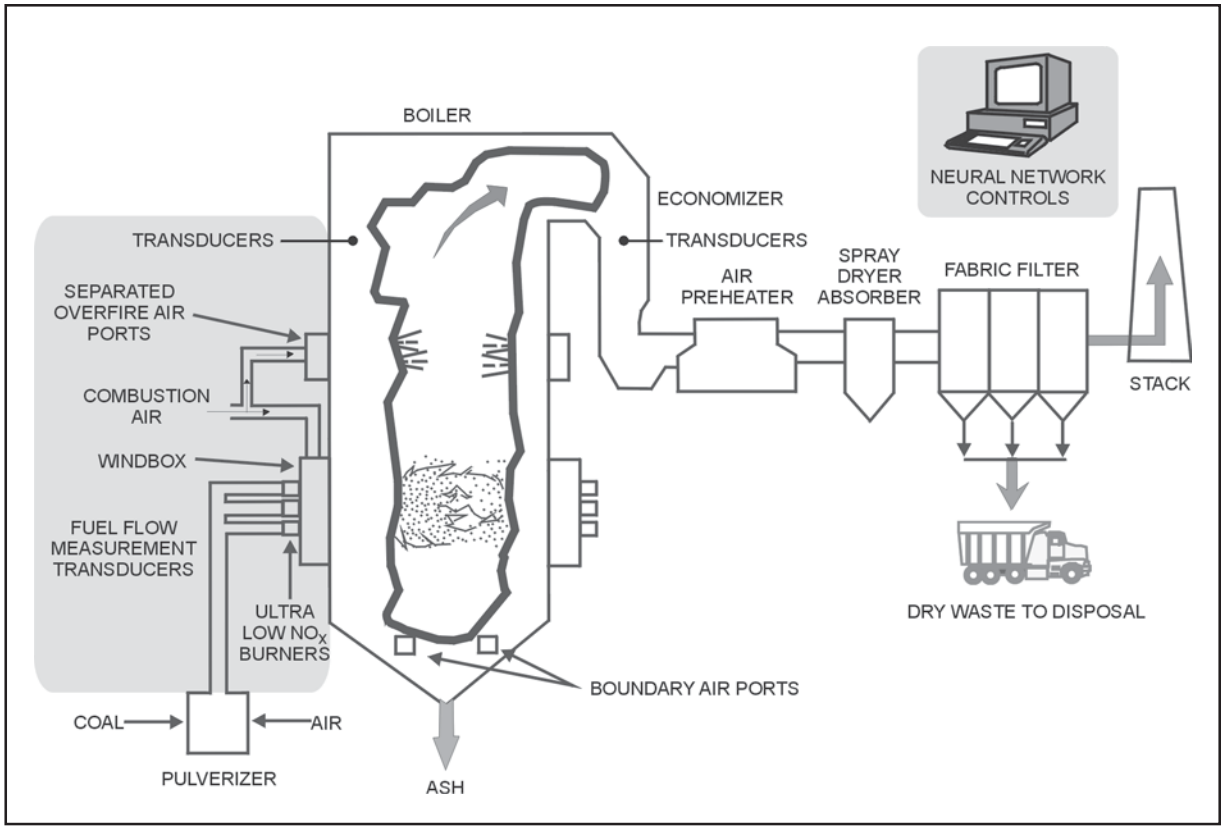
Technology
Ultra-low NO_x burners with other combustion-stage controls

Plant Capacity/Production
360 MW

Coal
Subbituminous coals

Project Funding

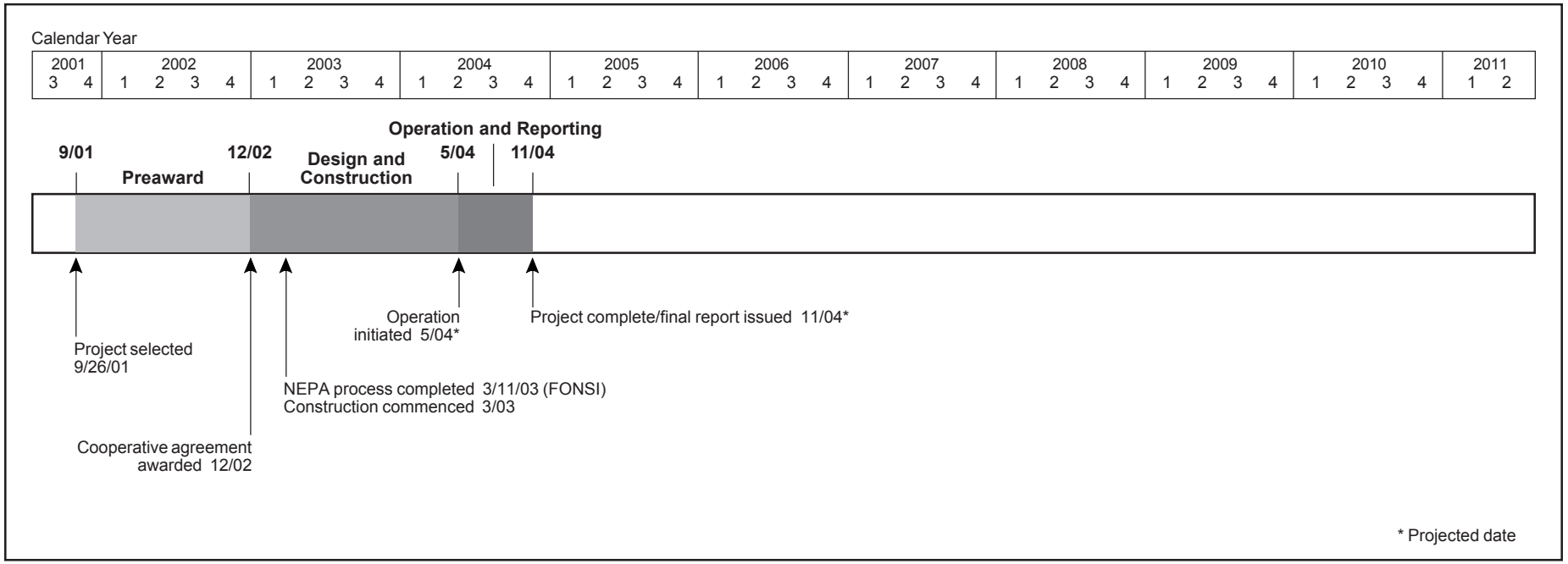
Total	$5,881,675	100%
DOE	2,796,326	48
Participant	3,085,349	52



Project Objective
To demonstrate low-NO_x burners with other combustion-stage controls with the goal to reduce NO_x emissions to 0.15–0.22 lb/10^6 Btu and simultaneously increase power output by 7 MW, demonstrating a concept that has never been illustrated in plants using subbituminous coals, including those from the Powder River Basin (PRB).

Technology/Project Description
Low-NO_x Burners (LNB) have been in development since the late 1970s and are in general use on many steam-electric generating units. Increasing demands for overall reductions in NO_x emissions have continued to put pressure on manufacturers to improve burner design. The existing low-NO_x burners were modified. When used with separated overfire air (SOFA) they have been found capable of reducing emission rates to very near the current New Source Performance Standards (NSPS) level of 0.15 lb/10^6 Btu.

To further reduce NO_x emissions, the participant will employ five elements: (1) low NO_x burners, (2) separated overfire air, (3) fuel flow measurement transducers, (4) fuel/air balancing, and (5) advanced network controls.



Project Status/Accomplishments

The project was selected for award on September 26, 2001. The cooperative agreement was awarded on December 17, 2002. DOE issued the Environmental Assessment in March 2003 and signed the Finding of No Significant Impact (FONSI) on March 11, 2003. Construction began immediately and some of the equipment is already in place.

The full application of the five elements proposed herein have never been demonstrated in plants firing subbituminous coals, especially those from Wyoming's PRB. Likewise, there are no other wall-fired units on which owners have sought to fully explore the technology proposed to its fullest potential. The inclusion of the very latest in distributed control systems, proposed for this unit in 2003, make this location ideal for integration with the proposed elements. The unit on which this technology will be applied has among the very best availabilities and performance histories for boilers of its type. It was placed in commercial operation in 1983 and is equipped with the latest SO_2 scrubber and fabric filter for particulate matter. When completed, this will be among the cleanest non-SCR-equipped coal-fired units in the United States. The Sunflower LNB/SOFA integrated system would be installed in three distinct phases to demonstrate the synergistic effect of layering NO_x control technologies.

Phase I, Advanced Monitoring/Coal Flow Measurement, would demonstrate the effectiveness of control upgrades with respect to NO_x control and thermal efficiency, with minimal impact from physical modification of the boiler. During this phase, instruments capable of measuring coal flow within individual coal conduits would be installed. Limited changes would be made to the plants' computing and control systems.

Phase II, Low-NO_x Burner Modifications/Coal Flow Control, would demonstrate the effectiveness of low-cost modifications to the existing, first-generation low-NO_x burners for the reduction of NO_x emissions. Modifications to the existing pulverizer classifiers would permit automated fuel balancing among all burners and would include the installation of new burner tips and a better means of controlling air flow on individual burners.

Phase III, Advanced Overfire Air/DCS Integration, would demonstrate deeper NO_x control competitive to SCR installation with the addition of an overfire air system that would be coupled with the existing Phase I and II modifications to optimize system performance. Final combustion control integration with a new combustion control system (a contemporaneous improvement not included as a part of this project) would maximize potential NO_x reductions.

Commercial Applications

There are as many as 30 units for which this technology can be deployed that will be able to meet the current NSPS level. A further 60 units will be able to establish significant reductions, to levels of about 0.22 lb/10^6 Btu. This choice of equipment, if enabled in a timely fashion, will allow a reduction in the number of SCRs being installed, thereby reducing the overall consumer cost; will reduce the outage duration necessary for completion, thereby improving the electric system reliability; and will conserve the critical pool of skilled labor needed to accomplish this work.